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Reducing the Geographic Variance in Medical Expenditures: The Benefits of a Primary-Care-Oriented Health System

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Reducing the Geographic Variance in Medical Expenditures: The Benefits of a Primary-Care-Oriented Health System

Abstract

The Affordable Care Act states that a primary goal of health care reform should be to lower costs and promote fiscal responsibility. With these two goals in mind, the bill proposes a more primary-care-oriented health system by enacting a 5-year temporary Medicare fee increase for primary care physicians as a means to increase the number of physicians and incentivize more primary care services. Using county and regional level Medicare data, this paper finds that an increase in the number of primary care physicians per capita would reduce per beneficiary Medicare spending and as a consequence, lower national health expenditures substantially.

Keywords

Primary Care, Health Economics, Medical Expenditures, Affordable Care Act

I. Introduction

The evaluation of a national health care system focuses on three major criteria: cost, quality, and accessⁱ. In all three categories, the United States performs abysmally when compared with other OECD countries. For example, per capita medical spending in the United States is approximately three times the OECD average; yet life expectancy is lower, the infant mortality rate higher, and the quality of care near last. The international consensus on the US health care system is that Americans spend more, to get less, for a select fewⁱⁱ. However, certain areas within the United States outperform OECD health care leaders like Denmark, while other American cities perform significantly worse than even the American average. In 2003 for example, the average Medicare beneficiary in Minneapolis cost the federal government \$5,428 and on average received extremely high quality care, yet the average Medicare beneficiary in Miami received a lower quality of care for \$11,500ⁱⁱⁱ.

Several researchers have noted that if the US could merely reduce the highest spending areas to the American average, total Medicare spending could drop nearly 30%^{iv}. Thus, current researchers are intent on understanding these small area variations (SAV) in health care spending and finding potential solutions. Early research shows that the number of ordered tests, in-patient services provided, and surgical operations performed account for a large portion of the regional variation and that primary care physicians often limit the overutilization of these expensive treatments^{v vi}. Strong statistical evidence from the medical field supports these claims with recent findings that primary care directly reduces the number of hospital admissions, lowers readmission rates, improves patient health, and provides more effective care than specialist care^{vii}. As a result, health care reformists and government officials have started to consider policy measures that incentivize a more primary-care-oriented system as part of a short and long term solution to the overutilization of care.

Currently, these policies tend to focus on incentivizing the primary care physicians already present in the market to do more, and the specialists to think carefully before recommending expensive treatments. However, few researchers have focused on whether increasing the number of primary care physicians might cause a more primary-care-oriented health care system that reduces overutilization and leads to lower spending levels. Thus, I address the question of whether increasing the number of primary care physicians in the United States can lower national health care spending without lowering the quality of care.

My analysis reveals that significant reductions in national health expenditures, as high as \$2500^{viii} per Medicare beneficiary in some regions, can be achieved through increasing the number of primary care physicians from their current levels to the levels found in certain low-cost areas. These findings should spur

further research and be considered in the current reforms of the U.S. health system.

A short literature review is presented in Section 2, which is followed by a presentation of the data and methods in section III. The aforementioned regression results are discussed in depth by section IV with a short policy conclusion in section V.

II. Literature Review

The literature on primary care, defined as “health care at a basic rather than specialized level for people making an initial approach to a doctor or nurse for treatment”^{ix}, grew rapidly in the early 2000s. The influx emerged from three worrying trends: a perceived shortage of primary care physicians, a growing number of primary care physicians rejecting Medicare patients, and a continually shrinking pool of medical school graduates choosing primary care^x.

Barbara Starfield, Leiyu Shi, and James Macinko, all noted writers in the health care field, published a systematic review of the seminal works on the effects primary care has on different aspects of the health care system with “Contribution of Primary Care to Health Systems and Health.”^{xi} The in-depth review conducts a qualitative investigation of primary care’s role in the health care field. The authors present a convincing case that an increased number of primary care physicians and improved access would improve health for all Americans, but especially the most marginalized, through lowering mortality rates, improving self-assessed health, increasing life expectancy, and reducing acute hospital admissions. Almost the entire document focuses on how primary care affects health outcomes, not spending, yet these findings provide possible avenues for primary care to affect per capita spending and provide a foundation for my hypothesis.

Chandra and Baicker build from the compendium and earlier works by studying the effects of the physician workforce’s composition on Medicare spending and quality of care with an associational study using state-level data. “Medicare Spending, The Physician Workforce, and Beneficiaries’ quality of care” presents three main conclusions for state policy makers: higher Medicare spending is associated with lower quality care, the relationship could potentially be driven by intensive specialty care crowding out more effective basic care, and states with more primary care physicians as percentage of all physicians tend to have lower spending and a higher quality of care than the average^{xii}. The study provides a strong policy brief but performs only basic statistical analysis at the state level, which makes any definite conclusions hard to draw. Chandra and Baicker do have other more regression-based analysis on related materials, but focus more on the growth of medical spending.

More mathematically rigorous studies have been conducted in areas related to the topic, and Fisher et al. in “The implications of Regional variation in Medicare Spending. Part 1: The Content, Quality, and Accessibility of Care” provide the strongest quantitative evidence showing that the overutilization of inpatient services plays a major role in driving excessive medical spending. They find inpatient admissions and hospital days, frequency of tests and specialist visits, and numbers of procedures account for large portions of the geographic variance in spending^{xiii}. Following his research, I attempt to meld his findings with earlier primary care research to see if primary care affects medical spending, potentially through the avenues highlighted in earlier literature. Like Fisher, I choose to take a more regression-based approach to test explicitly how primary care affects spending with the hypothesis that the supply of primary care physicians will significantly reduce the per capita level of Medicare spending.

III. Study Data and Methods

Data Sources and Type

The dependent variable of Medicare spending per beneficiary comes from the Dartmouth Health Atlas’s (DHA) comprehensive data set, which includes a wide-variety of domestic health care data. The variable contains the Part A and Part B reimbursements for all beneficiaries and is broken down into 306 hospital referral regions (HRRs) that encompass the entire United States. I chose DHA data over raw data from the Centers for Medicare and Medicaid Services (CMS) because prior literature favors the former, due to the adjustments for price, race, sex, & age built into the expenditures calculations^{xiv}. The price-adjustment is done by diagnosis related groupings (DRG) weighting and allows for researchers to test more accurately for other causes of regional variation, though price variations are of concern. For several supplementary regressions, I work from disaggregated portions of the total Medicare spending data that is broken into such components as Hospital Reimbursements, Ambulatory care sensitive Hospital Reimbursements, and Outpatient Reimbursements.

Additionally from Dartmouth Health Atlas, I take my primary variable of interest, the number of primary care physicians per 100,000 residents in each HRR. The label primary care physician applies broadly to general practitioners, family practice doctors, and in my case geriatricians to compensate for my use of Medicare data. Other hospital control variables come from the DHA data set as well, such as the number of acute care hospital beds and end-of-life hospital spending. Furthermore, the hospital quality index, also used in a supplementary regression, includes a comprehensive assessment of the quality of care of each hospital in the country calculated through an amalgamation of readmission rates, effective procedures, consumer satisfaction, and several other indicators. Previous

literature suggests that more primary care physicians in an area leads to higher levels of quality in hospital care as well as lower recovery times for procedures^{xv}^{xvi}, which my results generally support. The DHA provides average scores for each HRR, which is what I include.

Several other databases provide important information for my control variables such as the Robert Wood Johnson Foundation (RWJF), the Census Bureau (SAIPE), the Center for Medicare Services, and Area Resource File (ARF). These databases provided county level data for income, health, education, and demographic characteristics. From prior literature, I followed precedent in assigning these variables to all 306 Hospital Referral Regions. Dartmouth Health Atlas provides a lengthy and detailed explanation of how to assign counties and zip codes to each HRR, which is provided in a convenient data set for merging. The data was compiled in excel and then merged into a single data set for regression analysis in STATA 13C.

A summary of the data is presented in Table 1 and shows the mean, standard deviation, minimum, and maximum for the major control and interest variables discussed in the results. In 2006, the average Medicare beneficiary required almost \$8,000 in care, but the standard deviation and divergent minimum and maximum values show the regional variation present with an almost \$8,500 difference between the lowest spending and highest spending region. The disparities in poverty as well as spending in the last six months of life should be noted, although the two are not correlated in any way. Worth noting as well from a basic summary of the statistics is the wide variance in the number of primary care physicians and medical specialists by HRR. The maximum number of primary care physicians is nearly three times the minimum value and the same wide disparity exists with the number of medical specialists.

Analysis and Methods:

To disentangle the relationship between the number of primary care physicians and the level of total Medicare spending at the HRR level, I use least-squares linear regression, following precedent. The primary variables of interest are the level of Medicare spending per beneficiary and the number of primary care physicians per resident, which are then supplemented by a number of controls.

In an attempt to control for health status across HRR, I use percent of individuals who smoke regularly, the self-reported health average, and the adult obesity rate. Few previous regressions have controlled for health based upon the inability to have data on the specific Medicare beneficiaries, yet I choose to do so because of the strong correlation between many county level demographic and income statistics for the elderly and young.

To control for socioeconomic issues, I used poverty rates and percent of persons with only a high school degree. Poverty rate captures such statistics as employment status, income, and other household characteristics and explains more variation in Medicare spending than other combinations of wealth variables^{xvii}. Educational level is commonly controlled for through the portion of a population with only a high school degree.

For medical controls, I controlled for a culture of high intensity care, commonly cited in literature, with the total amount of spending in the last six months of life, which also has precedent in earlier literature and makes logical sense. Physicians willing to undertake expensive procedures that cost substantial sums of money to save an individual in the last six months should also be willing to spend higher sums of money in general on the care of individuals in a region. I used number of hospital beds to control for supply driven care that might come from the attitude “We have the beds so let’s fill them.” To test for physician-induced demand, I control for the number of specialists in a region because of recent literature that suggests specialists induce more procedures than necessary for the increased monetary benefits of performing more procedures^{xviii}.

Before moving to the results, I wish to note several possible econometric issues with testing my intended hypothesis. First of all, there is a considerable issue with finding the direction of causality and the potential for simultaneity bias in my equation. Primary care physicians may work in areas where there are high levels of Medicare spending in an attempt to increase incomes. This would hurt my ability to find a significant effect. On the other hand, Medicare offers very low reimbursement rates and may cause primary care physicians to leave areas with high levels of Medicare spending, which might actually strengthen some of my results. Furthermore, many of the control variables contain some degree of correlation and make discerning causality all that much harder.

Additionally, heteroscedasticity could be an issue as variance might vary with larger populations, different attitudes toward health, and demographic characteristics for spending as well as many of the control variables. For this reason, I used heteroscedasticity-controlled standard errors to remove bias from my hypotheses tests. Lastly, my model may suffer from omitted variable bias because there are many variables that are nearly impossible to control for in the health care market as far personal relationships between hospitals and insurers, market power, state regulations etc. Furthermore, the health care market is so interconnected that causality is almost impossible to establish, yet regressions still provide helpful information that should be used to formulate policy.

IV. Results & Discussion

Before discussing regression results, see Graph 1 for a basic correlation graph of the number of primary care physicians per resident and total Medicare

spending per beneficiary for each HRR. Though no specific avenue of impact can be identified through a basic correlation, the $-.4$ correlation value between the two variables shows a strong association but falls short of showing any stronger evidence. The negative association results between the two variables is not surprising but nevertheless, provides a strong point of departure for more analytical regression results.

The regression results reinforce the earlier correlation graph and shows that an increase in one primary care physician per 100,000 residents, while holding all other regressed variables constant, will reduce total Medicare spending for Part A and Part B by \$44 on average for a HRR region (see table 2). The finding is consistent with earlier research that shows primary care reduces overutilization of expensive services, which then would reduce Medicare spending levels, but my regression results provide strong evidence that the supply of primary care physicians is worth considering for policy measures. The results are not only statistically significant with a t-score of 9.09 but also are economically significant as can be shown by the following analysis. If the average HRR increased the number of primary care physicians by a single standard deviation, Medicare spending per beneficiary would drop by about \$528. The amount may not seem substantial but that there were 49.5 million Medicare beneficiaries in the United States in 2013 and the number has risen substantially since. The result would be a reduction in Medicare Spending nationally of over \$26.1 billion dollars for 2013, which does not take into account the benefits provided to the rest of the population.

Several other coefficients, beside the variable of interest, are worth noting in conjunction with other theories about the causes for small area variation in medical spending. The total specialists variable is not positively significant, which may suggest physician-induced demand, at least among specialists, is not as prominent as many have feared. The evidence is not conclusive by any means, since we are only looking at the broad measure of all specialists in a region, but the result is worth note. However, the number of hospital beds in a region is statistically significant and carries a large economic significance too. The 486.97 regression coefficient suggests that each additional hospital bed per 1000 residents adds almost \$487 dollars per Medicare beneficiary in average spending. The result provides support for the idea that hospitals will keep the beds in the hospital full to maximize revenue. Although not an unexpected result, it provides evidence that supply driven spending takes place in health care markets.

The signs and significances of the other control variables match with theory and do not provide any surprising results. The only other variable worth mentioning is the significance of the logged Medicare enrollees per region. The result suggests that having more Medicare enrollees in an HRR leads to a higher level of spending per beneficiary. The finding might suggest that regions with

large Medicare populations cater more to the needs of the elderly and might even target the elderly, likely Medicare beneficiaries, for more intensive care knowing Medicare covers the fees. While the evidence for such a theory is vague at best, the result deserves further research.

In exploring how primary care physicians reduce spending, we can see from table 3, which holds regression results for discharges for ambulatory care sensitive cases in hospitals as the dependent variable and the number of primary care physicians per beneficiary as the variable of interest, that one way is through unnecessary visits to the hospital. Ambulatory care sensitive discharges measures the number of patients a hospital admits for issues like asthma, diabetes, or minor injuries that could be taken care of by a primary care physician. The regression shows that increasing the supply of primary care physicians by 1 physician per 100,000 residents while holding all other regressed variables constant, reduces the number of ambulatory care sensitive discharges by almost a quarter of a visit per 1,000 Medicare beneficiaries and is statistically significant. While that may not seem substantial, the average hospital admission now costs \$2,168^{xix}, so the quarter of a visit reduction in the number of discharges associated with adding one primary care physician per 100,000 residents results in about \$542 per hospital discharge for an Ambulatory Care Sensitive condition among Medicare beneficiaries.

A common argument against reducing spending states that quality will diminish with less spending, although there is substantial evidence that more spending often leads to lower quality care^{xx}. My regression data actually suggests that hospital quality will improve with an increase in primary care physicians, though not in a meaningful way. In table 4, the number of primary care physicians holds economic significance with the dependent variable of hospital quality, though the increase in quality is marginal at best. For this reason, primary care should not be used as a policy mechanism to increase the quality of care in hospitals, as it is fairly inefficient, but the results provide support for the argument that Medicare spending can be reduced without harming the already low quality of care in the United States.

V. Policy Recommendations and Conclusions

The regression results support policy reform that increases the supply of primary care physicians in the United States as a means to reduce the high levels of Medicare expenditure per beneficiary as well as overall health care spending. While my results do not explicitly show how primary care reduces spending, there is a substantial literature that suggests one major avenue is through the reducing the overutilization of tests, procedures, in-patient services, and superfluous care. These effects would take place quickly and would be further built upon by a long-term improvement in health for Americans, which might hold a more long-term

solution to exorbitant medical cost levels. Even with such substantial benefits, engineering policies to increase the supply of primary care physicians is not easy or without political traps.

There are many methods to increase the supply of primary care physicians, essentially ways to incentivize and subsidize primary care physicians, yet as many economists would note using a basic supply and demand model that an increase in the supply would only further depress wages for primary care physicians. These reduced wages would only widen the incredible wage gap between primary care physicians and specialist doctors, which plays a large role, in my opinion, in the original shortage. I argue that is not the case with right set of policies and incentives.

The wages of primary care physicians are hardly tied to the market price of their services due to third party payers in the form of large insurance companies and the federal government. Therefore, it is possible to raise the incomes of primary care physicians even if the market price for their services drops with the increase in supply. This seemingly paradoxical result could be achieved by setting much higher reimbursement minimums for insurance companies, Medicare, and Medicaid through the federal government. In fact, primary care physicians only receive about between 5% to 30% of the market price currently for their services under Medicare, and even less for Medicaid and some large insurers because of a lack of market power^{xxi}. If that number were to be increased to 50% across the board, incomes as well as lifetime earnings for primary care physicians would increase dramatically even with a slightly lower market price. Therefore, I agree with the ACA initiative to increase Medicare reimbursement fees, although I would argue for a larger permanent increase across all payment parties rather than the small temporary Medicare increase in the bill.

In addition to raising the reimbursement rates for primary care physicians, I would provide debt alleviation for medical school students who choose primary care to achieve quicker changes in the supply of primary care physicians^{xxii}. With less debt and higher incomes, primary care physicians would receive more adequate compensation for the value contributed to the health care market. As critics will note, the measures to increase the supply of primary care physicians will cost money, but with the large savings from reduced medical spending and an overall healthier population, I believe the cost for such measures will pale in comparison to the savings.

A more controversial, but possibly more effective, policy would be to allow the immigration of highly qualified primary care physicians to the United States along with the increased compensation methods shown earlier in order to keep incomes from dropping substantially. The increase in supply would be immediate, rather than take place over 4 years, and might achieve similar results, although more research into the topic should be done. Additionally, further research should

formally look to do a cost benefit analysis of subsidizing an increase in primary care physicians as a possible solution to high levels of medical spending.

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^{xvii} Personal observation from working with my data

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Data Appendix
Table 1

Summary Table				
Variable	Mean	Std. Dev.	Min	Max
Total Medicare Reimbursement with Price, Age, Sex, and Race Adj.	\$7,944	\$1,155	\$5,634	\$14,011
Hospital Specific Medicare Reimbursement with Price, Age, Sex, and Race Adj.	\$3,967	\$618	\$2,506	\$5,837
Outpatient Specific Medicare Reimbursement with Price, Age, Sex, and Race Adj.	\$857	\$190	\$457	\$1,645
Total Number of Medicare Enrollees	92,959	84,717	15,502	508,813
Ambulatory Care Sensitive Hospital Discharges	74.9	18.0	29.7	135.2
Number of Acute Care Hospital Beds per 1,000 Residents	2.5	0.6	1.4	4.7
Primary Care Physicians per 100,000 Residents	70.5	12.0	43.9	117.0
Total Specialists per 100,000 Residents	120.1	20.8	68.3	215.0
People Living in Poverty (Percent)	14%	5%	4%	37%
People with only a high school degree (Percent)	29%	6%	9%	49%
Residents Self-Reporting Fair to Poor Health (Percent)	15%	4%	0%	33%
Obese Adult Residents (Percent)	26%	4%	13%	35%
Regular Smoking Residents (Percent)	20%	5%	0%	40%
Average Spending in the Last 6 months of life	\$13,027	\$3,454	\$7,788	\$32,633
Average Age of Beneficiary	71.6	1.4	67.0	75.0

Table 2

Primary Regression with Total Medicare Spending as Dependent				
Number of obs= 306				
F(12, 293) = 27.50				
Prob > F = 0.00				
R-squared = 0.54				
Root MSE = 797.41				
Dependent Variable				
Total Medicare Reimbursement with Price, Age, Sex, and Race Adj.				
Independent Variables	Coef.	Std. Err.	T-Score	P>t
Primary Care Physicians per 100,000 Residents	-43.53	4.79	-9.09	0.000
Total Specialists per 100,000 Residents	6.40	4.24	1.51	0.132
Number of Acute Care Hospital Beds per 1,000	486.97	88.30	5.51	0.000
CMS Hospital Quality Score	-4,404.66	2,041.37	-2.16	0.032
Last 6 months Medicare Spending per decedent	0.15	0.03	5.61	0.000
People with only a high school degree (Percent)	29.16	9.72	3.00	0.003
People Living in Poverty (Percent)	21.52	13.34	1.61	0.108
Ln(Total Number of Medicare Enrollees)	179.65	69.09	2.60	0.010
Average Age of Beneficiary	-29.44	40.36	-0.73	0.466
Regular Smoking Residents (Percent)	36.43	9.79	3.72	0.000
Residents Self-Reporting Fair to Poor	-18.01	12.73	-1.41	0.158
Obese Adult Residents (Percent)	-12.67	22.80	-0.56	0.579
Constant	9,837.99	3,332.23	2.95	0.003

Table 3**Hospital Discharges for Ambulatory Sensitive Care**

Number of obs = 306

F(12, 293) = 48.17

Prob > F = 0.000

R-squared = 0.70

Root MSE = 10.00

Dependent VariableHospital Discharges For
Ambulatory Sensitive
Care

Independent Variables	Coef.	Std. Err.	T-Score	P>t
Primary Care Physicians per 100,000 Residents	-0.240	0.076	-3.17	0.002
Total Specialists per 100,000 Residents	0.008	0.044	0.18	0.856
Number of Acute Care Hospital Beds per 1,000	16.573	1.149	14.43	0.000
CMS Hospital Quality Score	1.502	27.075	0.06	0.956
Last 6 months Medicare Spending per decedent	0.002	0.000	7.07	0.000
People with only a high school degree (Percent)	0.307	0.116	2.65	0.008
People Living in Poverty (Percent)	-0.021	0.152	-0.14	0.892
Ln(Total Number of Medicare Enrollees)	1.748	0.883	1.98	0.049
Average Age of Beneficiary	-3.211	0.515	-6.24	0.000
Regular Smoking Residents (Percent)	0.410	0.154	2.67	0.008
Residents Self- Reporting Fair to Poor	-0.350	0.168	-2.09	0.038
Obese Adult Residents (Percent)	0.480	0.241	1.99	0.048
Constant	212.397	42.002	5.06	0.000

Table 4

Hospital Quality of Care				
				Number of obs = 306
				F(11, 294) = 4.65
				Prob > F = 0.000
				R-squared = 0.17
				Root MSE = .025
Dependent Variable				
CMS Hospital Quality Score				
Independent Variable	Coef.	Std. Err.	T-Score	P>t
Primary Care Physicians per 100,000 Residents	0.05394	0.0161	3.35	0.001
Total Specialists per 100,000 Residents	-0.00726	0.0128	-0.57	0.572
Number of Acute Care Hospital Beds per 1,000 Residents	-0.08432	0.3465	-0.24	0.808
Last 6 months Medicare Spending per decedent	0	0	-0.31	0.755
People with only a high school degree (Percent)	-0.00114	0.0310	-0.04	0.971
People Living in Poverty (Percent)	-0.09281	0.0450	-2.06	0.040
Ln (Total Number of Medicare Enrollees)	0.07817	0.2079	0.38	0.707
Average Age of Beneficiary	0.32364	0.1279	2.53	0.012
Regular Smoking Residents (Percent)	0.13565	0.0448	3.02	0.003
Residents Self-Reporting Fair to Poor Health (Percent)	-0.04386	0.0447	-0.98	0.328
Obese Adult Residents (Percent)	0.0257	0.0579	0.44	0.658
Constant	0.62382	0.0951	6.55	0.000

Table 5

Outpatient Spending				
Number of obs = 306				
F(10, 295) = 14.28				
Prob > F = 0				
R-squared = 0.32				
Root MSE = 158.49				
Dependent Variable				
Outpatient Spending per Medicare Beneficiary				
Independent Variables	Coef.	Std. Err.	t	P>t
Primary Care Physicians per 100,000 Residents	7.29	1.11	6.55	0.000
Total Specialists per 100,000 Residents	-2.78	0.73	-3.82	0.000
Number of Acute Care Hospital Beds per 1,000 CMS Hospital Quality Score	112.86	17.39	6.49	0.000
Last 6 months Medicare Spending per decedent	929.04	359.68	2.58	0.010
People with only a high school degree (Percent)	-0.01	0.00	-3.18	0.002
People Living in Poverty (Percent)	2.25	1.70	1.32	0.187
Ln(Total Number of Medicare Enrollees)	-0.15	2.35	-0.06	0.949
Average Age of Beneficiary	-7.45	12.97	-0.57	0.566
Regular Smoking Residents (Percent)	17.60	7.59	2.32	0.021
Constant	-0.36	2.21	-0.16	0.871
	-1,542.38	610.26	-2.53	0.012